Application Note:

RotorWay Track and Balance with the GX3

RPX-ARA-RW-000-TB-B

September 2016

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1 Equipment required:

Table 1 - Required Equipment

Quantity	RPX Part Number	Description
1	GX3	DynaVibe GX3
2	A01S30AP	Standard DynaVibe Accelerometer (1 kHz)
1	LIGHT-30	Optical Tach
1	TAPE-12	Reflective tape
2	B01	Angle bracket (90°)
1	B04	Optical Tach bracket
1	DynaTrack	DynaTrack (optional)

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2 Main Rotor Track and Balance

2.1 Equipment Installation

Lateral Accelerometer

Install the lateral accelerometer (RPX Part # A01S30AP) with angle bracket (RPX Part # B01) on the frame near the main rotor shaft on the passenger's side of the frame in the aft position (nearer the tail). Mount the accelerometer at 90° to the lengthwise axis of the aircraft with the cable pointed to the right of the aircraft as shown below. The orientation of the sensor is important and should be as close to 90° as possible.



Figure 1 - Lateral accelerometer mounting location

Vertical Accelerometer

Install the vertical accelerometer (RPX Part # A01S30AP with B01 angle bracket) on the front of the frame as shown below. The orientation of the sensor should be as close to vertical as possible with the cable pointing down. Route the cable into the aircraft cabin and tape securely to prevent any entanglement with the tail-rotor control system.

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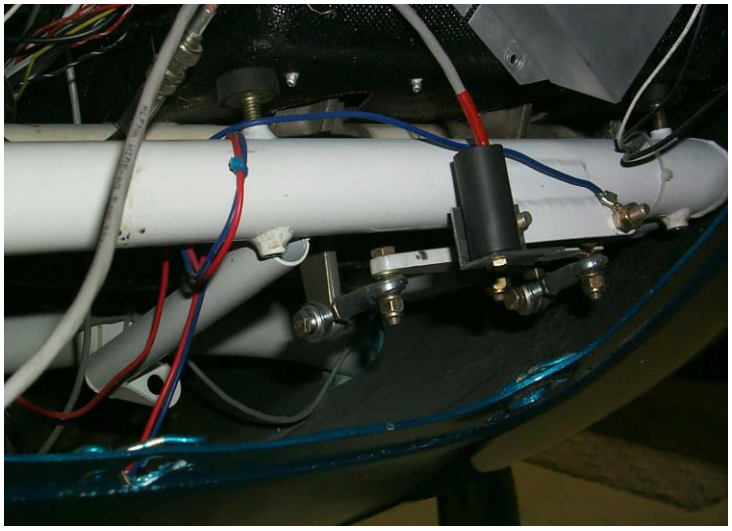


Figure 2 - Vertical accelerometer mounting location

Optical Tach

Install the optical tach along the centerline forward of the main rotor mast as shown, using a B04 optical tach bracket. Attach the reflective tape to the forward blade. This will make the forward blade the Master blade as it will be positioned nearest the DynaTrack when the optical tach is triggered.



Figure 3 - Vertical accelerometer mounting location

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Figure 4 - Alignment of the optical tach and blade

DynaTrack

Install the DynaTrack on the center of the windscreen centerline looking forward as shown below.



Figure 5 - DynaTrack installed on windscreen above center console

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Sensor Electrical Connections

1. Connect the DynaTrack to the DynaVibe GX
2. Connect optical tach to DynaTrack breakout cable.
3. Connect lateral accelerometer to left accelerometer input of GX.
4. Connect vertical accelerometer to right accelerometer input of GX.

DynaVibe Setup

Open Rotorcraft mode on the DynaVibe GX. Select the RotorWay entry and verify Rotor Diameter and Blade Chord match your Rotorway's blade geometry. Continue to the DynaTrack Setup screen.

DynaTrack Inclination and Roll Angle

While referencing the live Inclination angle and Roll angle indicators, adjust the DynaTrack mount and hinge to achieve 45° (± 3°) on the Inclination indicator with the Roll indicator centered on the middle bar.

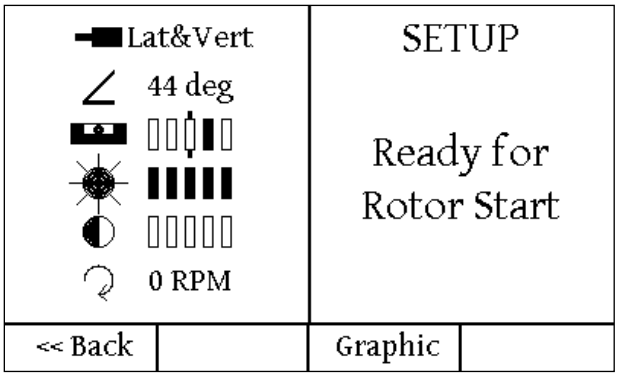


Figure 6 - Setup screen before rotor start, showing Inclination angle in degrees

Radial Focal Distance Adjustment

Start helicopter and verify that the distance out that the tracker is looking (Radial Focal Distance) is between 67% and 75% (Radial Focal Percentage) of rotor radius.

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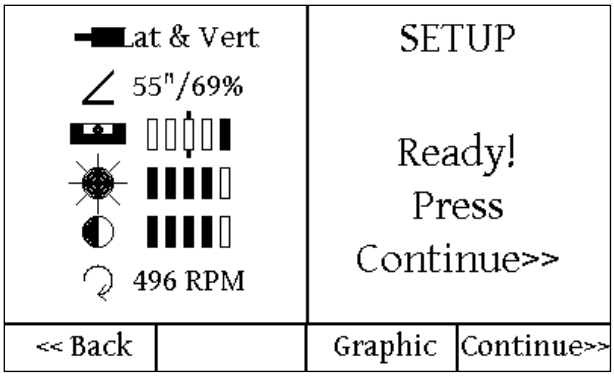


Figure 7 - Setup screen after rotor start, the second line now shows Radial Focal Distance and Radial Focal Percentage

2.2 Balancing Procedure

Reference the Rotorway Maintenance Manual for particular details, but in general use the following steps:

1. Check main rotor track in a hover. Adjust track with pitch link. Adjust track to within 0.25 inches.
2. Check main rotor balance in a hover. Adjust balance, as indicated by the “Hover (lateral)” main rotor balance polar chart, to 0.20 IPS or less. The chart is available at the end of this App Note.
3. Adjust blade track in cruise using track and vibration data. Adjust reflex trailing edge as indicated by the “At Cruise (Vertical)” main rotor polar chart. The chart is available at the end of this App Note.
4. Check main rotor balance in a hover. Verify no greater than 0.20 IPS.

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3 Tail Rotor Balance

3.1 Equipment Installation

The flexibility of the tail boom and the high frequency of the vibration make it difficult for the pilot to feel the tail-rotor vibration. However, like many other vibrations, the tail-rotor vibration causes excessive wear on the aircraft systems and should be reduced as much as possible.

By drilling a small hole in the X-support at the back of the tail boom, the accelerometer can be mounted directly on the aircraft. Additionally, the optical pickup is firmly attached to the X-support by securely taping the optical pickup to point at the reflective tape applied to the tail rotor blade, as shown below.

Accelerometer

Install accelerometer at the aft X-support with the cable pointed aft.



Figure 8 - Tail-rotor mounting of accelerometer, optical tac, and reflective tape

Optical Tach

Install the optical tach below the accelerometer, pointed toward the blades. Install a small piece of reflective tape on one blade and verify that it is aligned with the optical tach. The optical tach should indicate it detects the reflective tape by illuminating a small red LED on the back of the optical tach.

Sensor Electrical Connections

Connect the optical tach to the DynaVibe optical tach port. Connect the accelerometer to the left accelerometer input of the DynaVibe.

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Figure 9 - Cables routed along tail boom and into the cockpit to connect with the DynaVibe

3.2 Balancing Procedure

Use the Measure mode for balancing the tail rotor as this will provide the information necessary to use the included polar charts. Bring the tail rotor to full rpm and monitor the variation in magnitude and phase angle. If the readings tend to jump sporadically, there is probably a mechanical problem with the tail rotor linkage, or possibly the optical pickup is not centered on the reflective tape. If the readings are fairly repeatable, then make adjustments per the Tail rotor chart included at the end of this App Note.

To correct this imbalance, first mark the vibration magnitude and phase (for example, 0.53 IPS @ 10°) on the tail rotor polar chart. Then rotate the tail rotor blade until the reflective tape activates the optical pickup. Standing on the co-pilot's side of the helicopter, hold the tail rotor chart with 0° pointing aft along the axis of the accelerometer, as shown in Figure 10.

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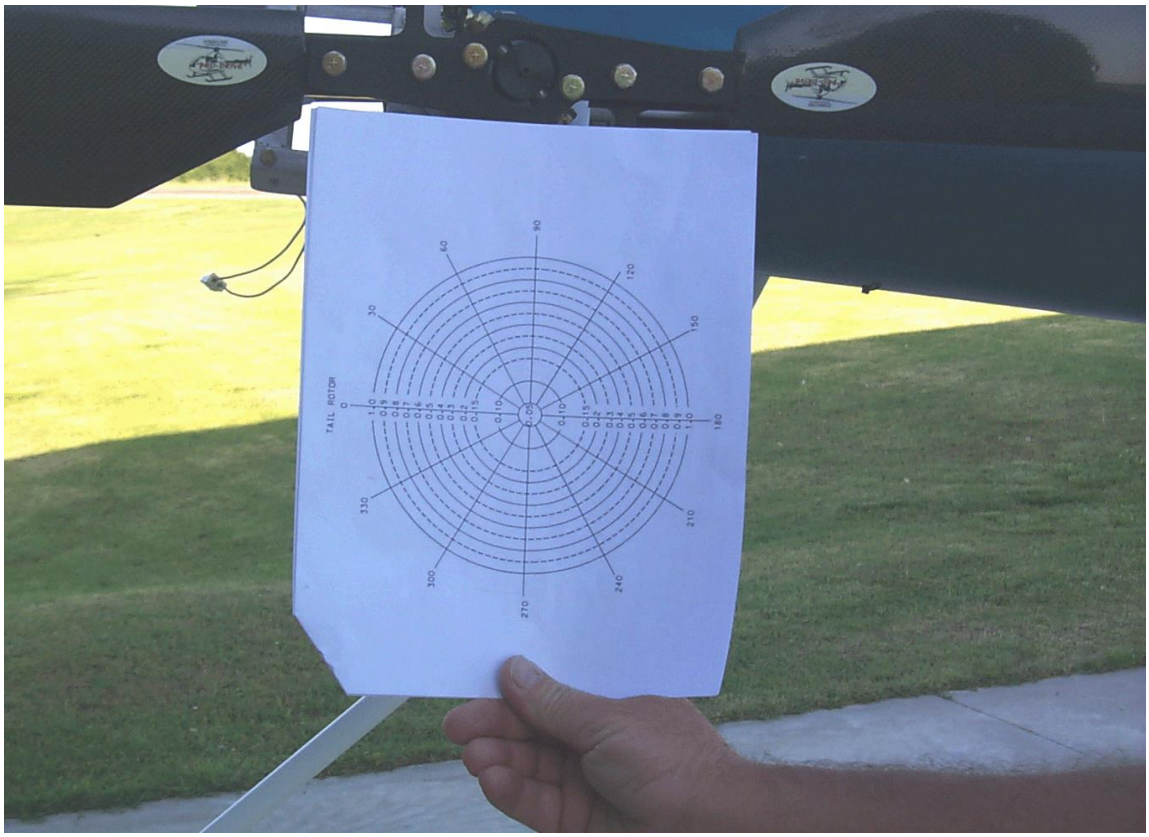


Figure 10 - Tail rotor chart with zero degrees pointing left (Aft)

This position marked on the chart is the heavy spot on the tail rotor system. Weight would be added at 180° opposite the heave spot. In our previous example (0.53 IPS @ 10°), we would add weight at 190° (10° + 180° = 190°). Use small weights at first to determine the amount of weight required for your tail rotor system.

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4 Spectrum

4.1 Additional sources of vibration

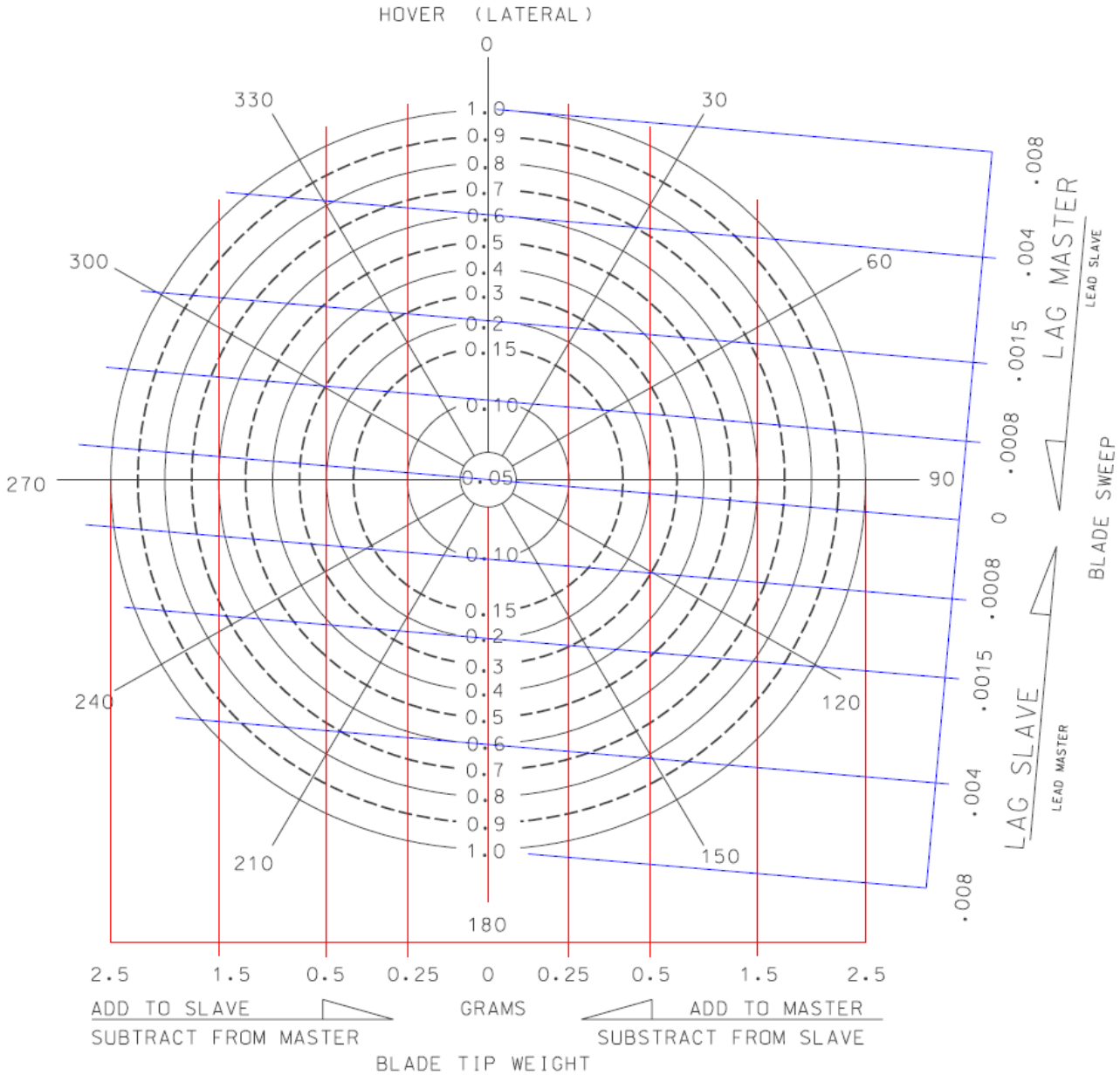
With the lateral accelerometer and optical tach mounted for main rotor balancing, the user may switch to Spectrum mode to determine what additional vibrations may be occurring on the ship. This could include the motor drive pulley, the secondary shaft, the water pump, the cooling fan, etc. Look at the spectrum of the vibrations to determine which component is vibrating and the magnitude of vibration. In general, vibrations should be kept below 0.20 IPS.

If a particular component needs balancing, you may relocate the accelerometer and optical tach to that component to use measure mode to get the magnitude and phase location of the imbalance.

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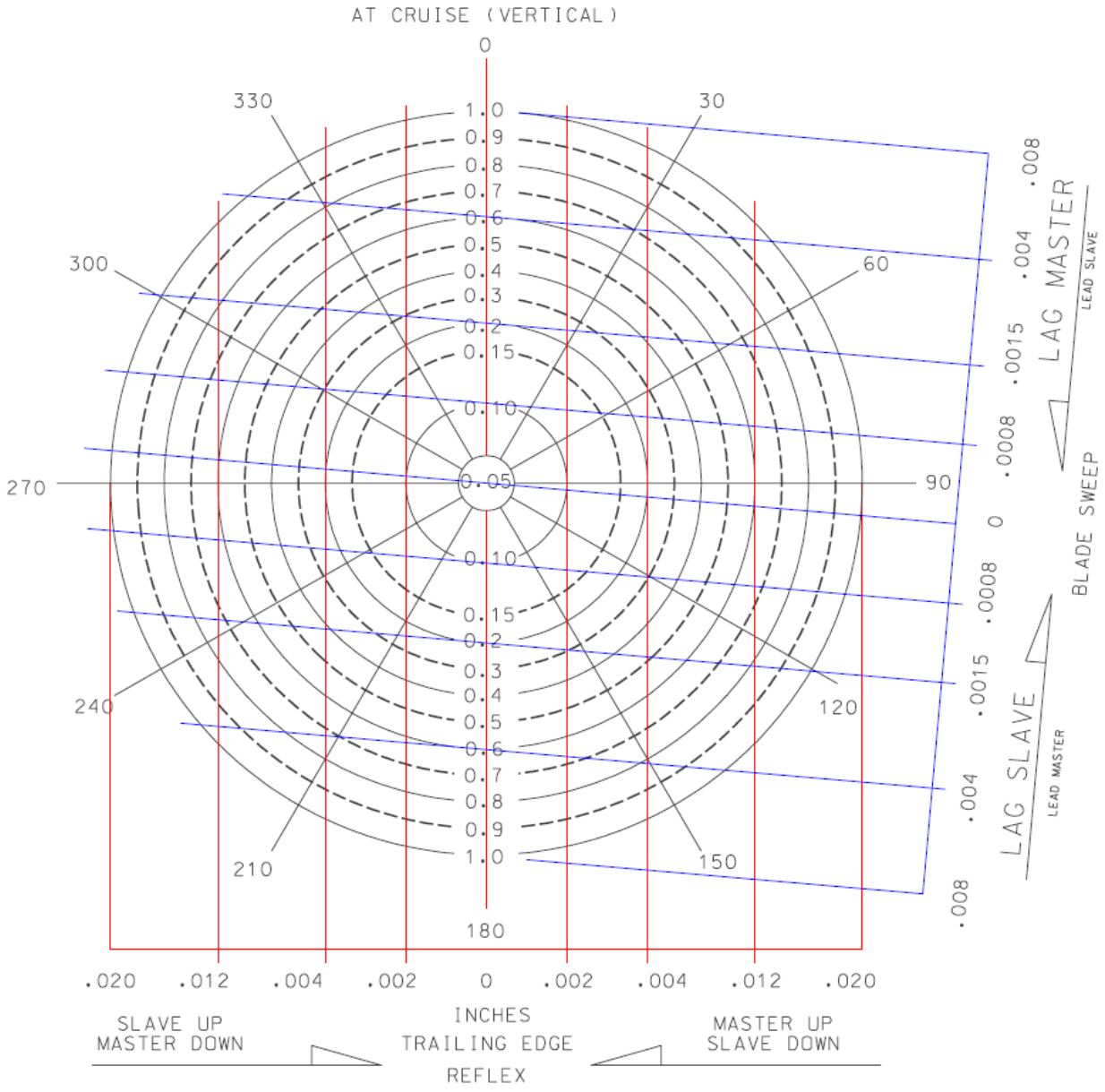
5 RotorWay Polar Charts

5.1 Main Rotor Hover (Lateral)



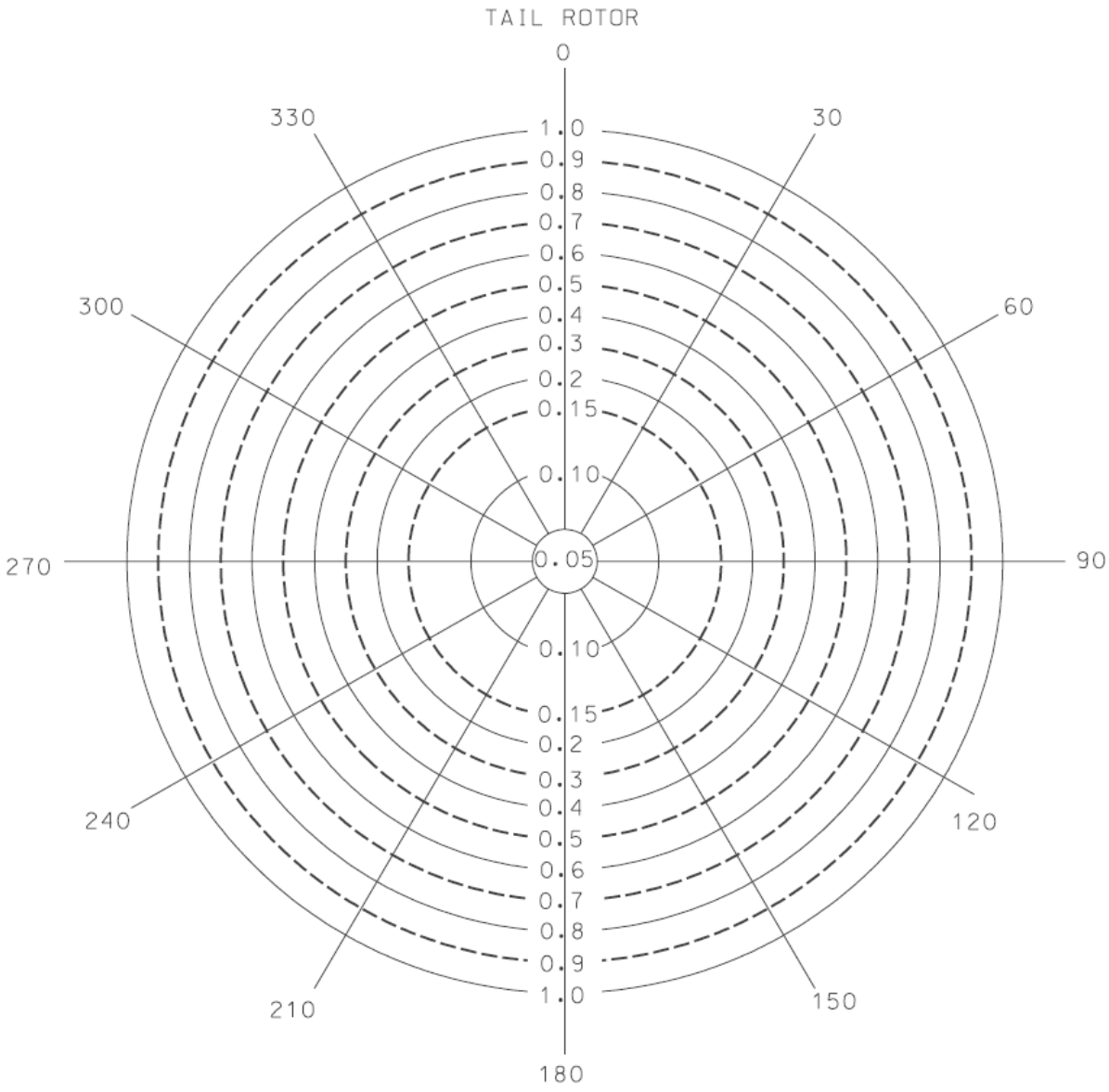
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5.2 Main Rotor at Cruise (Vertical)



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5.3 Tail Rotor



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